WINTER 72
HIVER 72

CANADA AGRICULTURE

Combining a seed supply of Span, the new rapeseed variety.

Moisson de la nouvelle variété de colza, la Span.

CANADA AGRICULTURE

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La revue trimestrielle *CANADA AGRICULTURE* renseigne les vulgarisateurs et représentants du négoce agricole sur les développements de la recherche et des autres services agricoles du gouvernement fédéral.

Les articles en anglais ou en français doivent être adressés au secrétaire du Comité de rédaction, Division de l'information, ministère de l'Agriculture du Canada, Ottawa.

CANADIAN VIEW OF THE OILSEED INDUSTRY

CONDENSATION OF A PAPER PRESENTED BY S. B. WILLIAMS, DEPUTY MINISTER OF AGRICULTURE, TO THE AMERICAN SOYBEAN PROCESSORS ASSOCIATION, IN MONTREAL, AUGUST 1971.

S. B. WILLIAMS

La demande croissante d'huiles végétales rend possible un accroissement soutenu de la production canadienne, sur une base concurrentielle.

Canada is the largest producer and exporter of rapeseed. Expansion of the industry has been tremendous in recent years and is expected to continue, although perhaps at a slower pace.

Canadian farmers grew about 5½ million acres of rapeseed last year. Yields have been averaging 800 to 900 pounds per acre but some growers have been producing more than 2,000 pounds per acre, and others much less. Yields will undoubtedly improve as growers gain more experience with the crop.

In spite of sharply increased production, demand has been strong, and there is little hint of a greatly increased carryover, even with a record crop in 1971.

The development of new rapeseed varieties, and particularly ones free of erucic acid, has been a success story for Canadian science. A great deal of credit must go to a small, dedicated group of professionals at Saskatoon, including Dr. Keith Downey of the Canada Department of Agriculture and Dr. B. M. Craig of the Prairie Regional Laboratory of the National Research Council. Together they developed a system whereby a single seed could be split, to carry out an accurate chemical test on one half, and grow a plant from the other. It gave the rapeseed breeding program a tremendous boost because foundation seed could be selected on the basis of chemical tests, and still have the power to germinate and multiply.

BREEDING OUT A CHEMICAL

Developing a variety free of one chemical ingredient was another major step in the science of plant breeding. Eliminating erucic acid from rapeseed may well be the first time that a plant breeder was able to breed a chemical out of existence.

The 1971 crop of erucic acid free varieties is expected to meet domestic requirements for Canbra oil and could supply enough seed to plant an entire crop in 1972. This means that we will have substantial quantities of this type of rapeseed for export by the fall of 1972.

At this point, it is difficult to predict the future with any degree of accuracy. The success of Canbra oil will depend to a great extent on the reaction of world buyers. Early tests indicate that it is more desirable as a salad and cooking oil, although it may have some minor drawbacks as a margarine oil. We will, no doubt, continue to find a market for our traditional rapeseed varieties, but it will be more specialized.

Canada will have a substantial competitive edge on world markets for the new Canbra oils because no other nation will be producing the new varieties in commercial quantities for at least two years.

In the long run, plant breeders are confident that better rapeseed varieties can be developed for the Canadian industry. Even now, they are taking the final steps toward development of varieties that will be free of both erucic acid and the thioglucocides which reduce the acceptability of rapeseed meal for use as a livestock feed supplement. If plans proceed on schedule, new thioglucocide-free varieties should be on the market by 1974 or 1975, giving Canadian rapeseed another hefty boost on world oilseed markets.

IMPROVED MEAL

In North America, an improved rapeseed meal could be expected to supply a significant portion of the protein supplement required by an expanding livestock industry. Ontario and Quebec feed mills would no doubt find rapeseed meal an attractive alternative to soybean meal, particularly if plans go ahead for the construction of major rapeseed crushing plants in eastern Canada.

Right now most rapeseed crushing is done in Western Canada. There has been a tremendous expansion in crushing capacity there, and we now have more than adequate facilities to handle the crush required for domestic markets. The future for exports of rapeseed oil is somewhat uncertain at this time however. Exports have largely been whole seed sales. Crushing plants in western Canada have demonstrated conclusively that they have the technology and the ability to handle the rapeseed crop, but there will be stiffer competition from other Canadian crushers in the years ahead. As the crushing industry develops in the west, the supply of rapeseed meal will increase. The improved quality, and use of meal will add impetus to livestock production.

What is the limit for rapeseed production in Canada? Much will depend on relative prices for wheat, barley and rapeseed. Given fairly close returns per acre for rapeseed and wheat, Prairie farmers will normally choose wheat. It is an easy crop to handle, and one that they are familiar with. Generally speaking, rapeseed will remain competitive from the producer's point of view only if it enjoys some advantage over wheat, with regard to price or a ready market.

RAPESEED ACREAGE

From time to time, experts have suggested 10 million acres as the potential for rapeseed in Canada. Beyond that we might start to run into some difficulties with crop rotations and so on. We could probably surpass the 10 million acre figure in some years, but not likely on a consistent basis.

With a relatively new crop, one can expect new problems, including insects and diseases. Such challenges can be met however, and there is no reason why rapeseed will not continue to grow in importance. The Bertha army worm was finally brought under control, and that experience along with further research should enable us to handle the pest with more ease in the future.

S. B. Williams.

Right: More research is required to solve some of the problems with sunflower production in Canada.

Far right: Canada has the varieties and technology for increased acreages of soybeans, particularly in Ontario, but competition for world markets is keen.

The world market for vegetable oils is a growing one, and the outlook is for this growth to continue. There are several reasons for optimism, particularly in the short term. Per capita consumption is increasing in the more affluent nations of the world.

Largely as a result of increases in consumption, world stocks of oilseeds have been dwindling in recent years. Starting stocks for all oils and fats are down by about 10 per cent from last year.

In world trade of oilseeds, United States soybeans are certainly the leader. And the outlook in the U.S. indicates a tightening in the supply situation. U.S. plantings in 1971 were up by only seven per cent, and the net result could be that carryover stocks will fall by another 150 million bushels, leaving only a negligible amount on hand.

The world dairy situation has undergone a dramatic turn-around in recent months as well, and butter stocks have dropped quite sharply. The net result could very well be an even greater demand for oilseeds in the form of table and cooking fats.

PRICE TREND

The net result of this increase in demand, and decline in stocks, will be higher prices. There may well be some significant changes in the relationships between prices of various vegetable oils, but certainly the ground swell in the overall world market for oilseeds will retain pressures towards relatively high prices.

Markets for the byproducts of the crushing process, particularly livestock meals, have been growing steadily over the past few years. This trend cannot help but continue, and this too will put some pressure on oilseed supplies.

U.S. soybeans are the trend setter in world oilseed markets. They are sensitive to changes such as the recent drop in peanut production in the African nations, the increasing production today of the palm oils, and most recently, the shortage of sunflowerseed. These shifts in production influence the relative position of the various oilseeds, but the relative position of rapeseed to soybeans will continue during the coming year.

The Canadian soybean crop has been growing slowly and steadily over the past few years. Production in 1970 was the highest on record at about 10.4 million bushels. We imported more than 16 million bushels of soybeans from the United States in 1970, and our exports, principally to the United Kingdom, continued to decline. As a result, Canada ended up as a net importer of nearly 20 million bushels of soybeans, when you take into account both our oil and meal imports. Although we have the varieties and the technology available to increase acreage significantly in Canada, it is not realistic to forecast any boom in soybeans in the near future.

Shipping charges influence Canadian soybean exports in relation to U.S. exports. Huge cargoes handled by the new and larger ships operating out of the Gulf of Mexico offer stiff competition for the smaller cargoes that are handled out of Montreal. For example, some of the ships that move out of the Gulf carry as much soybean cargo in one load as Canada exports in an entire year.

There is a small, but growing, sunflower industry in southern Manitoba, and doubtless this industry could be expanded quite substantially if we can put together some developments in research. The major hurdle appears to be weed control, but new varieties would be a help as well. Researchers are working on this aspect right now, and it may well be that in a few years the situation could be quite different.

I expect that we will see continued keen competition between Canadian rapeseed and U.S. soybeans for the large and growing markets along the Pacific rim, particularly in Japan. We in Canada certainly expect that we can gain improved trade terms for Canadian rapeseed in the Japanese market because United States soybeans are currently enjoying a substantial advantage. But even with this advantage, our rapeseed industry has opened up significant markets in Japan. We certainly hope to do even better in the future. ■

A. McLEAN

CATTLE TAKE PART IN MULTI-RESOURCE DEVELOPMENT

Les recherches sur l'aménagement et la gestion des grands pâturages libres de la Station fédérale de recherches de Kamloops, en Colombie-Britannique, ont permis d'accroître l'intensité du pâturage. On a aussi remarqué une amélioration dans l'exploitation forestière, la faune et l'utilisation des réserves d'eau de cette zone intégrée d'aménagement multiple des ressources.

The use of Class 1 land—a relatively flat, deep soil—is readily apparent. There are few limitations to production. One can select a high yielding crop, and manage it intensively, aided by labor-saving equipment. High returns, and the ease with which they can be secured, account for the preponderance of agricultural production on this type of land.

That does not rule out more variable hill country entirely. While there are serious limitations to intensive agriculture in mountainous regions, they can be overcome to some extent by good management. In fact, man may have to learn to manage sloping terrain, inaccessible to machinery if he is to feed an expanding population.

Under different conditions of elevation, rainfall, quality and depth of soil, such as exists over the Pass Lake Unit (about 70,000 acres) of the Tranquille Forest Reserve in Central British Columbia, vegetation can vary from tiny lichens and sedges to towering Douglas Fir and lodgepole pine. Except for log-

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Cattle handling facilities at Pass Lake

ging operations, renewable natural resources are scattered, and difficult to mobilize.

Where the man on Class 1 land can specialize, and intensify management, the man in hill country has a more complex problem, as several resources may be integrated, and several interest groups may be involved. It is multi-use of integrated resources, and requires careful management of growth and development if the potential of the more important components is to be preserved.

Development of such areas can often be justified only if several users share the cost of facilities that make the resources accessible to all. For instance, tree thinning to improve timber production, or forage improvement for domestic and wild ungulates may not be practical or economical unless the returns are combined to provide road and trail facilities.

ROLE OF BEEF CATTLE

Under these limitations, beef cattle play a unique, integrating role.

Grazing management of the Tranquille Forest Reserve was placed under the control of the CDA Research Station, Kamloops, B.C., in 1947 through an agreement with the British Columbia Forest Service and the Tranquille Livestock Association. The Reserve lies about ten miles northwest of Kamloops in the vicinity of Pass Lake and Tranquille Lake, between 3,000 and 6,000 feet elevation. The number of cattle being grazed has been tripled in recent years through knowledge of grasses, and the effect of grazing, and other competitive vegetation on them. Thirty-six miles of trails and eleven miles of drift fence have led to better control and accessibility of the resources. Overall improvement of cattle production has been accompanied by improvement in wildlife, forestry and watershed interests.

On ranches bordering the Reserve, cattlemen normally have enough early grazing on the lower benchlands where they are located. As summer heat and drought takes its toll in the semi-arid region, ranchers look to the higher elevations of the Reserve for continued growth of forage. By early June, when the Reserve is declared open, cattlemen in the area drive their stock onto the slopes of the McQueen Lake area, at the lower edge of the Forest zone. By the middle 1960's, it was apparent that the McQueen Lake area was being overgrazed, and that pinegrass at the middle elevations (3,500 to 4,500 feet) was not being fully used. Half the cattle were subsequently herded to the Watching Creek basin in the forest zone. Cattle could be grazed at this middle elevation for a month before being moved onto the higher plateau.

SUMMER GRAZING

During the hottest part of the summer, cattle find feed and protection from the heat in the wet sedge marshes on the plateau at elevations of 4,500 to 5,500 feet.

Colder weather in late summer signals the beginning of the return migration. On the way down, cattle browse through the forest zone and end up on the lower slopes in late October.

The main plant community is Douglas Fir-pinegrass. Pinegrass dominates up to 80 per cent of the ground area and provides up to 65 per cent of the forage in the Douglas Fir zone.

Under management of CDA research officers, stocking rate increased from 400 head in 1948 to

1,080 in 1955. It has leveled out at 1,000 to 1,100 head a year, consistent with conservation of other natural resources. Logging was increased in the Reserve in 1955 and has been going on continuously since. By 1960, logged areas were being seeded to grass. To date, nearly 1,000 acres of 6,300 acres of timber sales have been seeded, the main species being orchardgrass, timothy, bromegrass and white clover. The seeding is confined to disturbed areas such as skid trails and decking areas.

For the first few years, cattle were turned out first on the Tranquille Creek slopes. The range was heavily infested with timber milkvetch at the time and a number of poisonings occurred. By holding this area for fall grazing, the difficulty with poisoning was overcome.

Yearling steers have had to be kept separate from the main herd of cows because the ranchers believed there was a disturbing influence when the two classes were together. Others did not want their yearling heifers bred, so the 3,400 acre Opax area was set aside for use by the steers and later bred heifers. From the Opax area, the steers were easily accessible for removal to early marketing in September.

FEED VALUE

Pinegrass is generally considered to be poor forage for cattle in the Caribou region, but in one trial near Pass Lake yearling steers on lodgepole pine-pinegrass summer range made a 5-year average daily gain of 1.75 pounds over 103 days, starting in early June. Cattle seemed to graze the pinegrass readily during June and July but tended to avoid it during the latter part of summer. Similar results were later obtained in a trial on the same type of range in the Caribou region over a 3-year period.

Average stocking rates of representative areas ranged from 4.8 to 10 acres per animal unit month in rather open stands of lodgepole pine depending upon topography, distance between waterholes and amount of deadfall.

CLIMATE

Pass Lake (elevation 3,200 feet), in the lower portion of the Reserve, has an annual precipitation of about 15 inches, over half of which falls between May and October inclusive. The snow depth varies from 1 to 2 feet. The May to October mean temperature is 52°F. The mean maximum is 71°F (July and August). The average frost-free period (above 28°F) averages 137 days.

Short term records from Saul Lake (elevation 4,800 feet) suggest that the annual precipitation there is about 17 inches. The June through September mean temperature is about 6°F less than Pass Lake. The frost-free period is about 80 days.

Cabins and barn at Pass Lake

Pinegrass range with a tree cover of lodgepole pine

VEGETATION

The vegetation on the lower half of the Reserve is typical of the Douglas Fir zone. The present tree cover, however, is mostly a medium dense stand of lodgepole pine alone or mixed with aspen. Pinegrass is the dominant forage. The main associated shrubs are wild rose, white top spirea, and russet buffalo berry. The most commonly occurring herbs are heart-leaf arnica, creamy peavine, wild strawberry and timber milkvetch.

The upper half of the range lies in the subalpine fir zone. Subalpine fir and spruce dominate the climax community; most of the zone, however, is now covered with lodgepole pine in relatively dense stands. The ground cover is sparse and consists mostly of red alpine blueberry along with mosses and lichens. Pinegrass may become dominant where the shade is not dense. Grazing is limited largely to wet meadows and forest openings.

The wet meadows of the subalpine fir zone occupy about 6 per cent of the zone in the reserve and furnish large amounts of palatable forage. The meadows are situated in drainage basins and flood in early spring and summer. They vary greatly in both vegetation and soils. The soils vary from Gleysolic mineral to muck and peat types. Some occur as floating peat bogs. Sedges usually dominate the cover although grasses increase in abundance as soil mineralization increases. The most common tall sedges are beaked sedge and water sedge while small ones are mud sedge and disperma sedge. Grasses are mostly bluejoint, red top and American manna grass. Bog birch and willows are often common to abundant.

Domestic and wild ungulate grazing requirements are not always compatible. With more experience, it is believed that any conflict in grazing habits between the groups of animals can be minimized. For example, it has been found that deer will continue to browse areas in the fall if cattle, grazed in the summer, are removed from the area before they shift their diet from herbs to shrubs.

After logging, grazing cattle tend to concentrate in the open areas to the point where they interfere with the regrowth of trees. By fencing, such areas, cattle can be kept off, or the grazing period or stocking rate controlled to minimize any harmful effect on reforestration.

At the Kamloops Station, research has been directed at learning basic information about range vegetation and its response to grazing. The effects of grazing and other environmental factors on survival and production of range species are studied as well as the yield of forage produced in various plant communities and under various management practices. As competition for Class 1 land becomes keener, there is growing assurance that cattle will still be able to make use of more inaccessible regions. ■

Wet sedge meadow in the subalpine fir zone

Cattle grazing on forest range

THE BERTHA ARMYWORM CRISIS

H. McDONALD

Une grave infestation de légionnaires bertha a causé d'importants dégâts aux cultures de colza dans le nord des Prairies. Nous donnons ici une vue d'ensemble de l'importance des dégâts et du développement de l'infestation.

In 1971 a record 5,475,000 acres was seeded to rapeseed in the Prairie Provinces, 625,000 in Manitoba, 2.75 million in Saskatchewan, and 2.1 million in Alberta. As we moved into the last week of July the crop stood tall, heavily podded and generally free of insect attack. A near record yield of about 20 bushels per acre and a record production of 104.6 million bushels of rapeseed was forecast.

Within days an unprecedented outbreak of the Bertha armyworm was underway. This involved an area roughly 50 miles wide, extending from Dauphin and Swan Lake in Manitoba, across northern Saskatchewan to Edmonton in Alberta, with worms averaging up to 300 or 400 per square yard in many fields. By the end of August, it was estimated by various sources that 190,000 pounds of Lannate insecticide powder, which cost farmers $1,852,500 at $9.75 per pound, had been sprayed on 968,000 acres of rapeseed (17.7% of the seeded acreage). Broken down by provinces, 11,000 acres (1.7%) were sprayed in Manitoba, 750,000 (27%) in Saskatchewan, and 207,000 (10%) in Alberta. At an average of $1.50 per acre for application, $1,452,000 was paid out to operators of aircraft. Thousands of additional acres were infested at levels that did not warrant control or which were found too late to spray.

The reduction in overall yield was negligible in Manitoba, about 1% in Alberta and less than 10% in Saskatchewan. However, in areas that suffered the worst infestations, many fields that were not sprayed were totally destroyed, and damage in some districts with large acreages, such as Shellbrook in north central Saskatchewan, was estimated at 30%.

On the basis of the above overall reductions in yield, and Statistics Canada production estimates for August 1971, roughly 5.7 million bushels of rapeseed were destroyed, worth $14,250,000 at $2.50 per bushel.

That's the statistical story! The campaign fought to save the most lucrative and readily saleable rapeseed crop in history is more than statistics. It is a story replete with emotionalism, deep concerns and at times near panic, with unbelievably long and frantically busy days, and with wonderfully co-operative efforts by whole communities, all levels of government, agribusiness, and the news media. The Bertha

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Left: A full-grown worm, about 1½ inches long, can destroy a rapeseed pod in 10 to 15 minutes. When mature they burrow into the soil and form a pupae, from which the adult emerges the next summer.

Map shows area of Bertha armyworm infestation.

Below: The Bertha armyworm moth has a wing expanse of 1½ inches and is dark-colored with whitish markings. It flies, feeds on flowers and lays eggs around dusk during late June and July but is seldom seen.

armyworm was tough on resources, both financial and personnel, and all who were involved in the outbreak will long remember August 1971, as The Month of Bertha.

SURPRISE ATTACK

It is difficult to explain this massive outbreak. Our information indicated a widespread but generally very light infestation in Saskatchewan in 1970; heavier infestations had occurred in several years since the last serious outbreak in 1956, but were not followed by even a light outbreak. Whatever factors were at work, all must have been extremely favorable to maximum survival of each stage of development, i.e., overwintering pupae, adults, eggs and larvae.

This is how the story unfolded. An unusually heavy flight of moths was revealed by our captures in light traps in northeastern Saskatchewan. This was evident by the end of June and was the first indication of what was to occur. Widespread infestations of larvae were found during a survey completed on July 20, but because many were small and could not be found in the dense foliage or on the ground we still did not have a true picture of the number of worms. This was not long in coming.

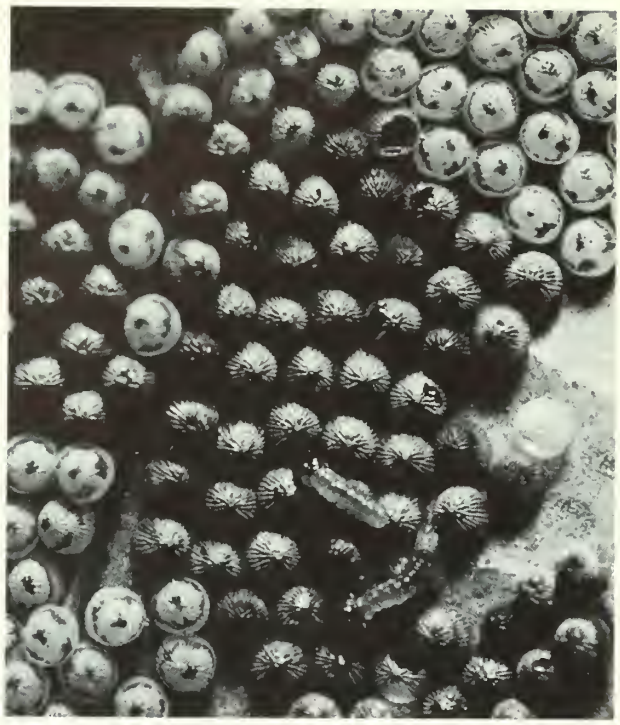
Soon the older worms changed from an inconspicuous green color to a conspicuous velvety black and began to feed on the pods and stems instead of on the foliage. They could now be seen easily. An infestation was reported in one field on July 20, and in another in the same district on July 30. Several were reported in another district on July 29. By August 3 frantic farmers were besieging their Agricultural Representatives in all districts from northeastern Saskatchewan to North Battleford in west-central Saskatchewan. The Bertha armyworm outbreak was underway.

SOUND OF WORMS EATING

Within a few days, infestations were reported westward to Lloydminster and then into Alberta; on August 9 infestations were reported in Manitoba, thus spanning the whole of the northern rapeseed growing area. In the more heavily infested districts, 75 to 95% of the rape fields were infested. Where the worms averaged 200 to 400 per spare yard, which was not uncommon, the plants appeared almost black and the sound of the worms moving about and eating on the pods could be heard clearly. Untreated fields could be destroyed in less than a week.

When the outbreak developed there was no effective insecticide registered for use on rapeseed. DDT had been withdrawn because of its persistence in the environment and endrin because it was known to leave residues in the oil and meal. Fifteen insecticides had been tested in our laboratory at Saskatoon since 1964, but only one, Lannate, was promising. This was confirmed in a field test in 1970 (in the first suitable infestation found in several years), but an application by the manufacturer to have it licensed for this purpose had not yet been approved.

When the seriousness of the outbreak became apparent on August 3, an urgent appeal was made by officials of the Saskatchewan Department of Agriculture and registration was granted on August 5. The same officials negotiated around the clock for the use of a Canadian Armed Forces Hercules Transport and for purchase of Lannate from Houston, Texas, the closest source of supply. The first ship-



Eggs, which are about the size of a pinhead, are laid in flat patches on the underside of the rapeseed leaf. Note two newly hatched worms.

ment of 15 tons was delivered to Saskatoon on August 6, and immediately distributed to several points. By nightfall it had all been used. This was to be the story for days to come.

FLEET OF AIRCRAFT

With crops 3 to 4 feet tall and vast acreages to be sprayed, aircraft seemed the logical method of application. Again there was a crisis and a delay in spraying in many districts for lack of aircraft, but planes, some from as far as Kansas, quickly responded to calls from farmers and provincial Department officials. Up to 150 aircraft were in operation across the prairies at the peak. They used local airports, pastures, exhibition grounds and blocked-off municipal roads as landing strips; farmers set up mixing stations at each base, took phone calls, set up spraying schedules, kept map and book records and acted as markers in the field. The pilots barely had time to stretch their legs between fillings so efficient did the crews become.

Some people became sick from the Lannate but recovered quickly after treatment. Considering their inexperience, and the long hours some were exposed to the insecticide, the wonder is that more were not affected.

Lannate at 3 to 4 ounces per acre generally gave satisfactory control, but lower rates were usually ineffective. Under the extremely high larval populations so common this year, anything less than 95% control could leave a residual population greater than the 10 to 15 larvae per square yard considered to be an economically harmful infestation. There were failures at the higher rates, however, and in a few districts a serious and vocal antagonism developed toward the use of this insecticide. In many cases the complaints were not valid, the residual populations being far below an economic level. Such was the concern and fear engendered by the outbreak that reason did not always prevail.

Where control was ineffective, it was attributed to one or more of many factors; poor spraying equipment, flying too high or too wide under windy conditions, using too little water, an extremely dense canopy that prevented penetration of the spray, and a wide variation in larval development. The latter situation resulted in the large larvae feeding on the upper part being killed while the smaller larvae feeding on the protected lower dense foliage survived. Under the above conditions it is probable that more persistent chemicals would have given only slightly better results.

FORECAST DOUBTFUL

Will there be a recurrence of the Bertha armyworm in 1972? We do not know. This will depend on how many pupae survive the winter to produce moths, and how many worms survive to the large black stage that can cause serious damage very quickly.

Previous studies have shown that overwintering mortality of the pupae may be as high as 80%, but is extremely variable and unpredictable. Heavy mortality is expected this winter because a large proportion of the pupae, instead of going into diapuase last fall, developed almost to the moth state. These will not survive. However, it is still possible that the number of pupae living in the spring of 1972 will be as high as it was in 1971 because of the very much larger infestations of larvae.

Overwintering stages of several kinds of parasites of the worms are very abundant in many fields and heavy parasitism is likely to occur in the Bertha larvae next season. Most of these parasites do not kill the host until late in its development, however, and therefore will not reduce the damage to any great extent.

Extensive observations to determine the size of the moth flight and the extent and number of the early-stage larvae will be necessary next summer to provide a forecast of what to expect in August 1972. The experience gained in 1971 and the supplies of insecticides that almost certainly will be stock-piled for rapid distribution to the rapeseed growing areas should permit an orderly and effective campaign to be waged if one is necessary. It is to be hoped we can avoid a repetition of the crisis that occurred in 1971. ■

A female mosquito, carrier of the sleeping sickness disease organism, is in position to lay eggs.

Moustique femelle, vecteur de la maladie du sommeil, en position de ponte.

POTENTIAL LURE FOR SLEEPING SICKNESS VECTOR

C. E. OSGOOD and
A. N. STARRATT

Western encephalitis, or sleeping sickness, is one of the more dreaded diseases of horses and man in western North America. Control is difficult and expensive. In 1969, when an epidemic threatened, the state of California spent 10-11 million dollars on control measures. This was largely involved in the control of a certain species of mosquito, *Culex tarsalis*, the vector or carrier of the disease. Attempts to control this vector have been hampered by restrictions placed on the use of persistent insecticides as well as acquired resistance to insecticides by the mosquito.

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ATTRACTIF POUR LE VECTEUR DE LA MALADIE DU SOMMEIL

C. E. OSGOOD et
A. N. STARRATT

L'encéphalite de l'Ouest, ou maladie du sommeil, est l'une des maladies des chevaux et de l'homme les plus redoutées de l'ouest de l'Amérique du Nord et dont la répression est difficile et coûteuse. En 1969, alors qu'une épizootie la menaçait, la Californie a dépensé de 10 à 11 millions de dollars pour sa répression. Cette somme a été en grande partie dépensée pour la lutte contre une espèce de moustiques, le *Culex tarsalis*, vecteur de cette maladie. La lutte a été entravée d'une part, par des restrictions sur l'usage des insecticides persistants, et d'autre part

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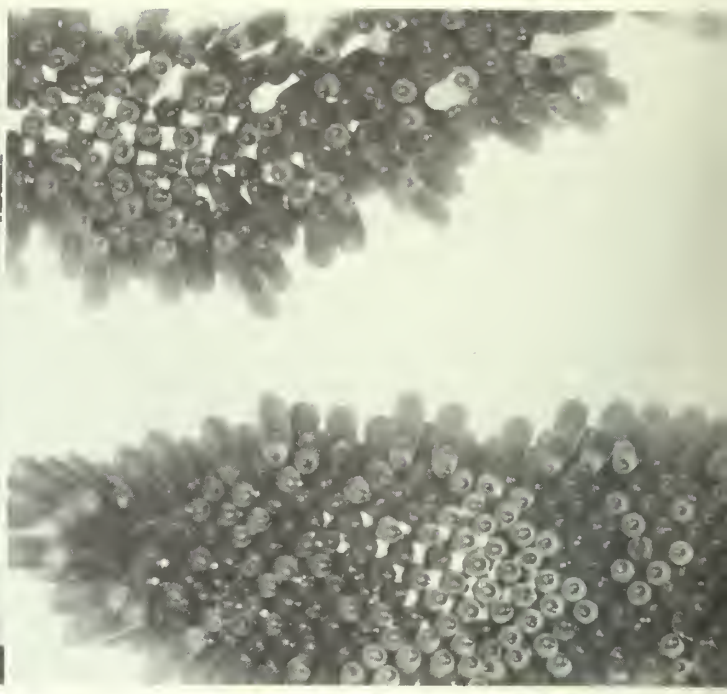
Photo shows an aggregation of egg rafts deposited by C. tarsalis, *carrier of sleeping sickness disease.*

Groupes d'œufs de C. tarsalis *flottants à la surface de l'eau.*



Close-up photo shows individual eggs in egg rafts laid by C. tarsalis.

Agrandissement montrant deux groupes d'œufs. On y distingue nettement chaque œuf.

A behavioral study of the insect was undertaken to identify factors that might be useful in a control program. During this study it was observed that females preferred to lay their eggs in dishes containing previously laid eggs or in water from which egg clusters or rafts had been removed. This preference was found to be due to a chemical on the eggs. The chemical was easily removed, and tests in a specially designed olfactometer proved that mosquitoes were attracted to the substance from a distance and therefore has potential for use in a control program.

Dr. Garth K. Bracken of the CDA Research Station, Belleville, Ont., assisted in isolating the attractant. Only one of five fractions of the lipid tested was shown to be attractive. Small quantities of this material were collected and by means of chemical, chromatographic and spectroscopic techniques, the active ingredient was shown to consist of a mixture of diglycerides of a type not generally encountered in nature. Work is continuing on the chemical structure of the attractant and on synthesis of the various components to determine the activity of each.

INSUFFICIENT SUPPORT

Apart from its attractancy, the active fraction also lowers surface tension when present in high concentrations. Applied to water it could make the surface ineffective in supporting mosquitoes, and they would drown while attempting to lay their eggs.

Other species of mosquitoes tested did not demonstrate any attractancy to the *C. tarsalis* attractant. The material has been termed a pheromone, that is,

par la résistance aux pesticides acquise par ces moustiques.

Une étude du comportement de cet insecte a été entreprise dans le but de découvrir des facteurs pouvant servir à sa répression. Elle a démontré que les femelles préfèrent pondre leurs œufs dans des plats ou d'autres œufs avaient déjà été déposés, ou pondre dans l'eau, d'où l'on a retiré des groupes d'œufs flottants. Cette préférence s'explique par la présence sur les œufs, d'un produit chimique. L'extraction de cette substance a été chose facile et des essais effectués au moyen d'un olfactomètre spécialement conçu ont prouvé que les moustiques étaient attirés, par cette substance. Ce produit chimique présentait donc un intérêt certain dans la lutte contre cet insecte.

M. Garth K. Bracken, de la station de recherches de Belleville (Ontario), a collaboré à l'isolement de cet attractif. Une seule des cinq fractions de lipides soumises à l'essai possédait cette propriété d'attraction. De faibles quantités de cette substance ont été recueillies, et des analyses chimiques, chromatographiques et spectroscopiques ont démontré que la substance active est formée d'un mélange de diglycérides d'un type peu courant dans la nature. Les travaux sur la composition chimique de cet attractif et sur la synthèse de divers éléments continuent afin de déterminer l'activité de chacun.

En plus d'être un attractif, la fraction active abaisse la tension superficielle (surfactif ou agent tensio-actif) lorsque la concentration est élevée. Si l'on ajoute cette substance à de l'eau, la surface peut ne plus supporter le poids des moustiques, qui s'y

it is a substance secreted by an organism that causes a specific reaction in other individuals of the same species.

The body of *C. tarsalis* was searched in hopes of obtaining quantities of the purified material directly from the insects themselves. By extracting lipids from whole as well as parts of the mosquito's body the following results were obtained using TLC techniques. 1) Males, and females without eggs, did not possess the pheromone. 2) The pheromone first appeared in females three days after they received a blood meal from chickens and was present only in their abdomens. 3) The ovaries were the only abdominal organs possessing the pheromone. An examination of chicken blood in order to check the possibility that the pheromone originated from that source proved negative, thus demonstrating that the substance was elaborated by the mosquito itself. It was concluded that extracting the pheromone directly from the eggs was the simplest procedure.

CREATURE OF ARID REGIONS

An examination of the geographical distribution of *C. tarsalis* reveals that while its range extends over much of the United States and western Canada it is primarily a species of the arid regions of the west where it has been reported as the dominant species of mosquito. These areas are characterized by low rainfall and in turn contain limited breeding sites. Therefore it is hypothesized that a species such as *C. tarsalis* which possesses a means of attracting members of its own species to these sites for oviposition would be favored in these areas over species without such a mechanism.

When identification and synthesis of the pheromone are completed, its usefulness as a specific control agent will be tested in the field. It may be possible, because of its surfactant nature, to treat selected breeding pools with sufficiently high concentrations of the pheromone that females will not only be attracted but will drown when attempting to land on the water surface. It may also be possible to attract ovipositing females to pheromone-treated pools of water or moist soil that will dry up before the larvae have had sufficient time to complete their development. Since *C. tarsalis* does not occur in eastern Canada, field trials in Alberta and possibly Saskatchewan are under consideration.

The material is believed to be the first insect-produced oviposition attractant to be isolated. ■

noient en voulant y déposer leurs œufs.

Des essais sur d'autres espèces de moustiques ont montré que ceux-ci n'étaient pas attirés par l'attractif du *Culex tarsalis*. Cette substance a été qualifiée de "phérormone", c'est-à-dire une substance sécrétée par un organisme et qui provoque une réaction spécifique chez les autres individus de la même espèce.

On a soumis le corps du *Culex tarsalis* à l'analyse, dans le but d'obtenir de petites quantités de substance pure directement des insectes eux-mêmes. L'extraction des lipides de tout le corps des moustiques de même que de ses parties, par des méthodes de chromatographie sur couche mince, a donné les résultats suivants: 1) Les mâles, et les femelles ne portant pas d'œufs ne sécrètent pas de phérormone. 2) La phérormone apparaît pour la première fois dans le corps de la femelle trois jours après que celle-ci ait absorbé du sang de poulet, et n'est présente que dans son abdomen. 3) Les ovaires sont les seuls organes abdominaux contenant de la phérormone. L'analyse du sang de poulet dans le but d'y détecter la présence de phérormone est négative; cette substance est donc synthétisée dans le corps des moustiques. On a aussi conclu que le moyen le plus simple d'obtenir de la phérormone était de l'extraire directement des œufs de l'insecte.

Un examen de la distribution géographique du *Culex tarsalis* montre que cette espèce s'étend sur la plus grande partie du territoire des États-Unis et de l'ouest du Canada. Toutefois, il est avant tout une espèce des régions arides de l'Ouest. Ces régions se caractérisent par une faible pluviosité, de sorte que le nombre de sites de reproduction est limité. On a donc émis l'hypothèse qu'une espèce comme le *Culex tarsalis* qui possède le moyen d'attirer dans ces lieux de ponte les autres individus de sa propre espèce serait favorisée, dans ces régions, par rapport à d'autres espèces qui ne possèdent pas de mécanisme semblable.

Lorsque l'identification et la synthèse de la phérormone seront terminées, son efficacité en tant qu'agent de lutte spécifique sera mise à l'épreuve sur le terrain. Il sera peut-être possible, à cause de ses propriétés surfactives, d'introduire dans certains étangs choisis par les moustiques pour y déposer leurs œufs des concentrations assez élevées de phérormone pour que les femelles y soient non seulement attirées, mais qu'elles s'y noient en tentant de se poser sur la surface de l'eau. Une autre possibilité serait aussi d'attirer les femelles sur des étangs ou des sols humides traités à la phérormone et qui seraient asséchés avant que les larves aient le temps de se développer pleinement. Comme le *Culex tarsalis* n'est pas une espèce connue dans l'est du Canada, on étudie actuellement la possibilité d'effectuer des essais pratiques en Alberta.

On croit que cette substance est le premier attractif de ponte, synthétisé par des insectes, à être isolé. ■

ECHOES
FROM THE FIELD AND LAB

Scientists at the Plant Research Institute, Canada Department of Agriculture, have developed a formula which will help extend the life of cut roses. (See story below.)

Les spécialistes de l'Institut de recherches sur les végétaux du Ministère ont mis au point une formule nouvelle pour prolonger la vie des roses coupées. (Voir texte à droite.)

MAKING CUT FLOWERS LAST LONGER Scientists at the Canada Department of Agriculture Plant Research Institute have recently developed a formula to improve the water uptake of cut roses. This extends their life, and also retains the color, of red roses particularly. A patent has been applied for.

With this new formula, when 12 rose buds are put in a vase, it is almost guaranteed that 12 flowers will develop. Also, the petals will be more turgid.

The problem of extending the life of cut flowers was given high priority at the Plant Research Institute three years ago. A scientist worked on it full time until last fall; since then, the Director of the Institute and Dr. E. V. Parups have continued the work on a part-time basis.

Most of the work has been with roses. It is on this flower that the new formula is most effective; snapdragons, carnations and other cut blooms were also used in the research, but existing commercial preservatives are equally effective on these flowers.

Many factors are involved in extending the life of cut flowers. Basically, the flowers must be fresh and free of insects and diseases. Time of cutting is of prime importance. Each kind of flower has an optimum time at which it should be cut. Just as important is the length of time flowers are stored after cutting; cut flowers continue to age after even the most ideal storage conditions. The Institute has tried to gain a better understanding of the aging process, to be able to control it more effectively.

Cut flowers will wilt if their stems cannot absorb enough water to offset water loss through transpiration. In many cases, this process is irreversible. It is not enough to equalize water loss; water is also needed to expand developing cells, particularly those in the flower bud.—DR. A. P. CHAN, DIRECTOR, CDA PLANT RESEARCH INSTITUTE, OTTAWA.

LA VIE DES FLEURS COUPÉES Des scientifiques de l'Institut de recherches sur les végétaux du Ministère ont créé un nouveau produit qui améliorera la capacité d'absorption d'eau des roses coupées. Leur vie en sera prolongée et les roses, surtout les roses rouges, conserveront leur couleur. L'Institut a déposé une demande de brevet.

À l'aide de cette nouvelle formule, il est presque certain que si vous mettez une douzaine de boutons de roses dans un pot, vous obtiendrez une douzaine de fleurs. De plus, leurs pétales seront fermes.

Il y a trois ans, l'Institut donnait la priorité à cette question. Un chercheur y a travaillé à plein temps jusqu'à l'automne dernier et, depuis lors, le directeur de l'Institut et E. V. Parups s'y sont intéressés à temps partiel.

Les recherches ont surtout porté sur les roses et c'est sur elles que la formule de préservation florale est la plus efficace. On a aussi utilisé des gueules-de-lion, des œillets et d'autres fleurs coupées, mais il existe déjà des produits commerciaux efficaces dans la conservation de ces fleurs.

Plusieurs facteurs contribuent à prolonger la vie des fleurs coupées. Les conditions fondamentales sont que les fleurs doivent être fraîches et exemptes d'insectes ou de maladies.

Le moment choisi pour la coupe des fleurs est d'importance primordiale. Chaque espèce doit être coupée pendant la période qui lui est la plus favorable. Un autre facteur important est la durée de la période d'entreposage; la maturation se poursuit même dans des conditions d'entreposage idéales. Les études de l'Institut avaient pour but de mieux connaître le processus de maturation afin de l'orienter le plus efficacement possible.

Si les tiges ne peuvent absorber assez d'eau pour compenser la perte par transpiration, les fleurs dépérissent. Dans plusieurs cas, ce processus est irréversible. Il ne suffit pas de compenser la perte d'eau: la fleur a aussi besoin d'eau pour assurer la croissance de ses cellules, surtout dans le cas de boutons floraux.—A. P. CHAN, DIRECTEUR DE L'INSTITUT DE RECHERCHES SUR LES VÉGÉTAUX DU MINISTÈRE DE L'AGRICULTURE, OTTAWA.

NEW RESEARCH LABORATORY AT OTTAWA It was recently announced at Ottawa that construction will begin at once on a new laboratory for animal diseases research in that city. The cost will be $11,520,600.00.

The laboratory is the main structure in an Animal Diseases Research Institute complex which has been under development for several years. It will be built in the Greenbelt Farm south of Ottawa for the Animal Pathology Division, Health of Animals Branch of the Canada Department of Agriculture.

Expressing pleasure at the announcement, Agriculture Minister H. A. (Bud) Olson said: "The livestock industry is one of Canada's largest, worth about $1.4 billion in annual sales. Its success depends largely on the health of our livestock population. That, in turn, depends on our research effort.

"Through the efforts of our scientists and the development of national policies and programs to control and eradicate disease, we have been able to develop one of the world's healthiest livestock populations. We will be able to maintain this record only if we exercise constant vigilance and if we support our research effort through the provision of adequate facilities."

The laboratory will house equipment and staff presently located in crowded quarters. It will also be the administrative headquarters for the Animal Pathology Division.

The 800-acre site in the Greenbelt Farm is adjacent to the Animal Research Institute of the CDA's Research Branch.

The laboratory will be the largest of eight similar research and diagnostic laboratories located across Canada.

CHARLOTTETOWN GETS NEW LABS AND OFFICES A modern three-story laboratory-office complex is being built as an extension to the Canada Department of Agriculture Research Station at Charlottetown, P.E.I.

A cooperative effort under the PEI Development Plan, costs of construction will be shared by the Canada Departments of Agriculture and Regional Economic Expansion, and the PEI Department of Agriculture and Forestry.

Space is provided in the new building for the increased demands on the Charlottetown station by the Development Plan. Under one roof will be the staffs of the research station and the provincial agriculture department's extension, production and veterinary services.

This integration will enable both departments to take their findings to the agricultural industry with the least delay.

Scientists at the station conduct research to solve practical problems affecting island agriculture. The object is to obtain the most crop productivity, so the island can fully and

ECHOS
DES LABOS ET D'AILLEURS

economically support an animal and cash crop agriculture.

The building is scheduled for completion in the fall of 1972. It is hoped that the cornerstone will be laid during the 1972 Agricultural Institute of Canada convention, to be held in Charlottetown in late June.

RICE POSSIBLE CASH CROP Rice may become another cash crop in the Chatham area of Ontario in the next few years. It has been grown at the Ridgetown School of Agricultural Technology, for the past five years, and yields are now averaging 3,500 lb. of rice per acre. This is considered good production.

Ridgetown averages 218 days per year annually, during which the mean temperatures are 42 degrees or above. This compares with 211 days in the rice growing areas of Japan.

The crop needs the equivalent of a 50 in. rainfall per year and, to meet this requirement, the rice is planted at a rate of 90 lb, or about 2 bus., per acre in three to six in. of water. This level is maintained from the last week of May until the end of September.

The seed is pre-soaked and spread over the paddies by hand. It sinks to the soil below the water and takes root.

Presently, Canada imports $12 million of rice annually. Officials at the Ridgetown station believe that the crop may be grown commercially in the area within the next two or three years.—ACTIVITIES REPORT, PLANT PRODUCTS DIVISION, CDA, OTTAWA.

NEW BOOK FOR GARDENERS A new gardening information series for both urban and rural readers has been started by the Information Division of the Canada Department of Agriculture.

The series, to be known as Gleanings from Garden Notes, has been prepared by the division, based on the department's popular press article series by A. R. Buckley. Mr. Buckley is an internationally known horticulturist who has been with the department for many years.

The new series is for those who enjoy home gardening. It will cover a wide range of topics, such as plants for rock gardens, the herb garden, landscape design, hardy ferns, geraniums, selecting garden trees and shrubs, and many more.

Individual leaflets are available free of charge, on request, from the Information Division, and will be used to answer queries on specific problems from the gardening public.

EARLY-RIPENING CRANBERRY DEVELOPED A new, earlier-ripening cranberry shows great promise for helping Maritime growers capture a larger share of the Thanksgiving Day market.

Both this variety, Ben Lear, and another, Stevens, performed well this year on cranberry bogs near Aylesford, N.S. Both are recent selections from the United States Department of Agriculture's breeding program.

Berries of both varieties are twice as large as those which have been grown in Nova Scotia. Ben Lear ripens faster, and Stevens is equal to the native varieties. At Aylesford, the Ben Lear variety had ripened sufficiently by September 20 for marketing.

The faster ripening Ben Lear shows special promise for Maritime growers who, because the currently grown varieties are barely ready for harvesting in time for Thanksgiving, find it hard to compete with cranberry shipments from the Cape Cod, Mass., area.

Only a limited supply of the two varieties is available this year, but a sharp increase in production is predicted for 1972.—I.V. HALL AND R. STARK, CDA RESEARCH STATION, KENTVILLE, N.S., AND R. A. MURRAY, NOVA SCOTIA DEPARTMENT OF AGRICULTURE.

POTATO HIGH IN PROTEIN CONTENT The potato, generally downgraded as a source of protein, has gained status in this respect following studies at the Canada Department of Agriculture Research Station, Lethbridge, Alberta. It has proven to be a better source of protein than most people believe it to be.

The protein content of fresh potatoes is only about two per cent, but with the water removed, it can run as high as 10 per cent—about equal to that of most cereals.

But quality of the protein is an important factor in assessing foods as sources of this dietary need—and the quality is exceptionally high in some potato varieties.

Comparing foods as sources of protein may be done by determining the kinds, amounts and dietetic values of the amino acids they contain. They are given a numerical rating based on the analysis data.

This was the method used for the studies.

Potatoes scored about 70, with some varieties going as high as 78 because of a higher level of the amino acid methionine.

By comparision, eggs, an excellent source of high quality protein, have a score of 100, beef and pork each rate 80, and wheat flour 50.

The main reason why potatoes out-score wheat flour is that they contain more lysine—one of the essential amino acids.

In the meantime, there is the possibility of new potato varieties being developed to provide even higher levels of protein.—M. S. CALDY, LETHBRIDGE, ALBERTA.

NEW CUTWORM INSECTICIDE LOOKS GOOD A new insecticide being tested at the Canada Department of Agriculture Research Station, Lethbridge, Alta., shows a great deal of promise as a means of controlling cutworms without creating a chemical residue problem. The tests are being conducted on an organo-phosphorus insecticide which has not yet been registered for use in Canada.

Earlier tests by entomologists at the station showed that the chemical was effective against cutworms. More recent tests, to determine the persistency of the chemical, show that it breaks down fairly readily under field conditions, and will not create a residue problem such as that encountered with some chlorinated hydrocarbon insecticides such as DDT and dieldrin.

When applied to wheat crops, the insecticide itself and the two main chemicals produced as it decomposed did not persist on the plants for more than four weeks after application. At that rate, it should not create a residue problem on plants. More testing is necessary, however, to determine the persistency of the chemical on other crops and in various types of soil.

Experimentation with the chemical is being done as part of CDA's extensive and continuing program of testing and screening all new pesticide products before they are registered and made available on the market. The new material may be registered and available for use against cutworms within a year.—D. L. STRUBLE, LETHBRIDGE, ALTA.

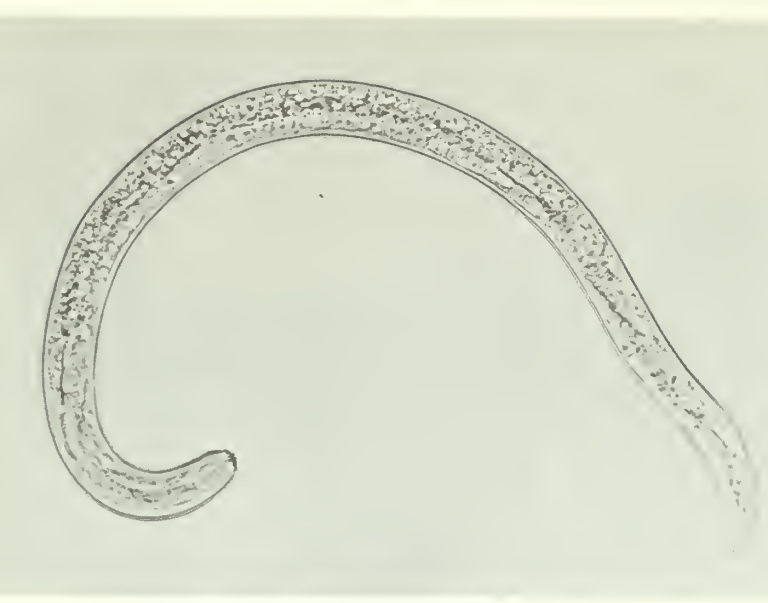
YOUNG BULLS AND STEERS CAN PROVIDE QUALITY MEAT Experiments and taste panel judgments at the Canada Department of Agriculture, Brandon, Man., indicate that, while young bulls of 12 to 14 months old on full feed from weaning to market produced meat of acceptable quality, meat from steers of similar age, breeding and feeding practice was still preferred.

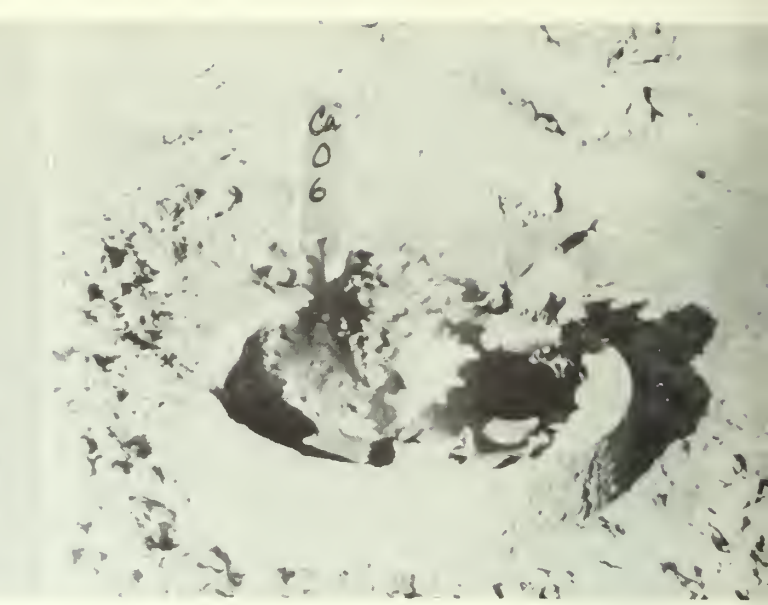
These are the types of meat recently tested at the station. The tests showed that, although meat from bulls was leaner, it was slightly less tender, less juicy and less flavorful than beef from steers.

The taste panel had no way of knowing whether the meat being evaluated was leaner or fatter, high or low in shearing index, or from bull or steer carcasses. However, it did prefer the somewhat fatter steer meat.

Broiled steer steaks proved to be more tender, more juicy, and more flavorful according to the taste panel. Tenderness of steaks was also measured, using a carefully calibrated mechanical shear test. Steer meat offered less resistance to shearing force and was thus recorded as more tender.

There was essentially no difference in tenderness of roasts from steer and bull carcasses but steer roasts were preferred for juciness.—R. L. CLIPLEF, BRANDON, MAN.





RELATING NEMATODE POPULATIONS TO CROP LOSSES

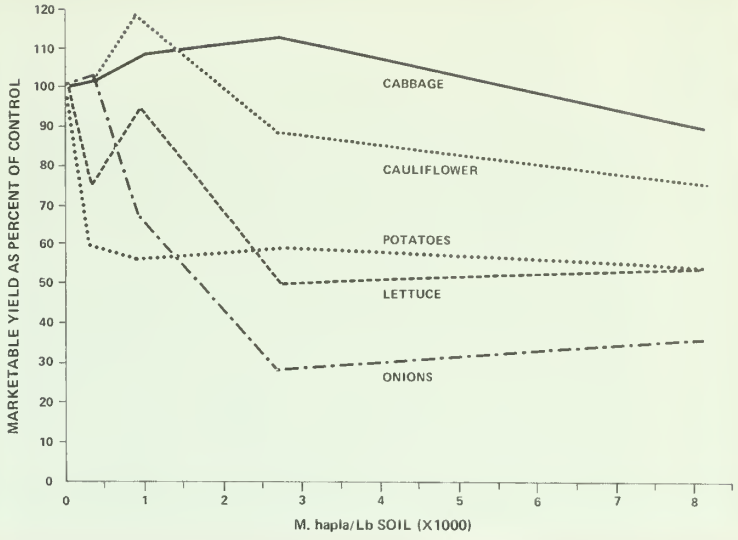
Th.H. A. OLTHOF and J. W. POTTER

Une méthode d'introduction d'un nombre connu de nématodes dans de mini-parcelles a fourni des données permettant d'établir des relations entre les populations de nématodes et les pertes de récolte; il semble que cette méthode deviendra une aide précieuse dans l'évaluation des moyens de lutte à mettre en œuvre.

Nematodes have been known to injure vegetable crops in Ontario for many years. However, research to date has not established the relationship between the number of nematodes in the soil and crop losses. Determining the population level above which crop damage may be expected, and below which soil fumigation is wasteful, has become a major objective in efforts to achieve efficient control without unduly disrupting the environment. The control recommendations issued by the Ontario Nematode Diagnostic and Advisory Service would be strengthened considerably with more reliable data relating nematode numbers to crop damage.

Because of the slow reproduction rate and limited mobility of most nematodes, there is usually a sound relation between the population density at planting time and subsequent crop damage. However, the extent of loss is influenced to a large degree by environmental conditions on the host-parasite relationship. Assessment of crop losses to date have usually been based on yield comparisons of nematode infested plots and those from which the nematode is eliminated or greatly reduced by soil fumigation. This method has several disadvantages: only one population density can be considered at a time; the size of

Drs. Olthof and Potter are nematologists at the CDA Research Station, Vineland Station, Ontario.



Left: In real life, this adult female root-lesion nematode is about 1/50 inch in length.

Left center: By mixing nematode-infested soil of known population with steam-sterilized soil in different ratios, volumes of soil of known population density are secured for comparative tests in clay drainage tiles.

Right center: Potato tubers show skin injury due to a severe northern root-knot nematode attack.

Right: Graph shows relationship between nematode population densities and marketable yields of five spring-sown vegetables.

the initial population varies throughout the plot; there may be more than one species present; and the chemical soil treatment itself may cause yield increases regardless of nematode kill. To overcome these disadvantages we have developed a technique that enables us to study the relationship between several different nematode population densities and damage to crops under field conditions without the use of soil fumigants.

MICROPLOTS

Initial studies involved the northern root-knot nematode, and five spring-sown vegetables. Large numbers of nematodes were reared in soil cropped to tomatoes and cabbage in a greenhouse groundbed. By varying the ratio of nematode-infested to steam-sterilized soil, we prepared quantities of soil of five known nematode population densities. Soil of each density was then placed in clay drainage tiles which were buried vertically in a field. At planting time, moisture and temperature sensors were placed in selected tiles at depths of 6 and 12 in.; samples were taken to confirm nematode population density and each tile inoculated with a small amount of air-dried soil to ensure the presence of normal microflora. The soil was sampled for nomatodes 45 days after transplanting and again after harvest of the experimental plots. The crops were analyzed for yield, grade of produce and rated for the degree of galling.

Economic loss for cabbage, defined as a 5% reduction in marketable yield, was evident only at the highest density tested (8100 nematodes/lb. of soil). Similarly, cauliflower showed a fair degree of tolerance to nematodes (see graph). However, the yield of marketable lettuce heads was reduced by densities as low as 300 nematodes/lb. of soil. This same population threshold also caused a marked decrease in the number of Canada #1 potato tubers and an increase in the number of undersized culls. Many tubers from the two highest density plots, where the yield was down by 41 and 46%, were covered with unsightly proliferations of parenchymatous tissue due to nematode attack. Losses to onions occurred at populations of 900 nematodes/lb. of soil and above. Counts of soil populations after harvest showed that potatoes and onions had supported a high degree of nematode reproduction, whereas lettuce, cabbage and cauliflower were much poorer hosts. With the latter two crops only about 25% of the initial densities were recovered at harvest time.

This same microplot technique was used to establish the relationship between densities of the root-lesion nematode, *Pratylenchus penetrans*, and three late-season vegetables. Yield reductions in lettuce, beets and spinach at the highest nematode density amounted to 43, 27 and 20% of the non-infested check plots, respectively. We intend to continue this work for the next few years and produce a guide listing damage threshold densities for our most valuable vegetables and their important parasitic nematodes.

At present we are using an adaptation of the microplot technique to determine damage threshold for the root-lesion nematode on flue-cured tobacco which is responsible for millions of dollars of damage each year in Ontario. The technique could also be used to study the role of various parasitic nematodes in disease complexes on other field crops under field conditions. In summary, the microplot approach has already yielded valuable data relating nematode densities to crop losses and shows every indication of becoming an important aid in our efforts to establish reliable guidelines for control recommendations. ■

HEAVY METALS IN PLANTS AND SOILS

M. K. JOHN

Des recherches préliminaires indiquent que le mercure, le plomb et la cadmium peuvent être absorbés et migrer dans différentes parties des plantes, à des degrés divers, sous l'action d'une multitude de facteurs.

Heavy metals in plants and soils are being studied under a soils and plant research program at the CDA Research Station, Agassiz, B.C. Cadmium, lead and mercury are of particular interest, since small amounts of them can affect human health more seriously than other typical heavy metals such as copper, zinc, nickel, aluminum and manganese. The objective is to better understand the fate of heavy metals entering the soil, their availability to several plant species from various soil types, and the possible abatement of this availability.

LEAD

In a survey of soil contamination in B.C., we analyzed about 700 surface samples, most of them from farmland. The level of soluble lead in these agricultural soils was found to vary from 1 to 360 lbs per acre, and was related to industrial and population centres. Samples containing over 100,000 lbs per acre were taken near a battery smelter. Lead levels were found to diminish rapidly as distance from the smelter and soil depth increased. Our studies also indicated that lead in soil of high organic matter and heavy texture tends to be less available to plants. We also observed a fourfold reduction in the lead content of lettuce and oat plants as a result of liming contaminated soils. While significant levels of lead were determined in some plant materials collected in the lower Fraser Valley, it is believed that only a small amount was translocated from the soil. Attributing these significant levels to particulate matter emitted by automobiles and industries would be in agreement with studies relating lead contamination to traffic density and proximity of highways and industries such as metal smelters.

CADMIUM

in a growth chamber test at Agassiz, lettuce and radishes were grown in 30 different soils to which cadmium had been added. Results indicated that relatively moderate contamination of soil may result in potentially hazardous accumulation of cadmium in plants. The allowable level for foodstuffs, arbitrarily set between one to two parts per million, may be easily exceeded when certain soils are contaminated. When 50 milligrams of cadmium were added to 500 grams of soil, the cadmium concentrations in edible portions of radishes and lettuce averaged 387 and 138 ppm respectively. Besides its effect upon the cad-

Dr. John is a soil chemist and soil fertility specialist at the CDA Research Station, Agassiz, B.C.

mium levels, the treatment produced toxicity symptoms and reduced yields (Figure 1).

Although comparable levels of cadmium are rarely found in agricultural soils (only one sample tested near a smelter exceeded this limit), this study emphasized that careful evaluation of the cadmium contamination from industrial and waste waters should be undertaken when such is used for agricultural purposes. We also developed mathematical models to predict the cadmium intake from different soils through the use of such factors as soil organic matter, soil reaction, aluminum activity, texture and exchange capacity. In yet another experiment conducted in the growth chamber, soil reaction was found to influence the plant's cadmium uptake. However, the results also indicated that liming to an optimum level can reduce cadmium uptake and translocation (Table 1). Such abatement may allow production of some crops on contaminated soils without resulting in levels that may cause health problems.

MERCURY

Experiments conducted in our laboratory are still in the preliminary stages, but the trends obtained to date appear to indicate that when soil is contaminated with very high levels of mercury, the plants are able to absorb and translocate it to the different plant parts. However, this differs greatly depending upon the plant species. Similarly, our studies with lead and cadmium showed the varied ability of different plant species to absorb heavy metals. We studied the pattern of metal uptake by growing several plant types in our growth chamber and analyzing the plant parts for cadmium, lead and mercury (Table 2). Both spinach and lettuce were found to absorb and translocate the heavy metals to the leafy portions, whereas peas were able to retain them at the root zone. Further experiments and observations are required before further evaluation, about mercury, can be given. ■

Fig. 1. Radish plants growing in Milner silt loam soil. Plants on the left show chlorosis of leaves and stunted growth due to cadmium treatment.

TABLE 1. EFFECT OF LIME AND CADMIUM ON THE CADMIUM LEVEL IN PLANT PARTS.

Amount of lime applied	Cadmium content of radish roots in ppm amount of cadmium applied			Cadmium content of lettuce tops in ppm amount of cadmium applied		
	0 lb/acre	10 lb/acre	100 lb/acre	0 lb/acre	10 lb/acre	100 lb/acre
0 tons/acre	1.8	3.7	65.4	7.1	50.8	99.1
5 tons/acre	1.2	2.0	35.9	6.4	28.7	113.8
10 tons/acre	1.2	2.2	29.9	6.7	32.0	124.0
20 tons/acre	1.4	2.8	28.1	5.5	27.1	85.4

TABLE 2. ACCUMULATION OF HEAVY METALS IN DIFFERENT PLANT PARTS.

Plant Variety	Plant part	Cadmium content of plant parts in ppm Amount of cadmium applied		Lead content of plant parts in ppm Amount of lead applied		Mercury content of plant parts in ppm Amount of mercury applied	
		0 lb/acre	80 lb/acre	0 lb/acre	2000 lb/acre	0 lb/acre	40 lb/acre
Oat	grain	0.9	16.1	3.2	4.9	0.009	0.020
	leaf	0.9	45.7	6.0	20.1	0.176	0.199
Pea	seed	1.3	2.4	5.4	4.0	0.001	0.012
	root	4.0	532.1	13.1	536.4	0.011	2.965
Carrot	tuber	0.6	26.3	1.9	41.0	0.044	0.059
Spinach	top	2.9	208.6	0.7	42.8	0.094	0.695
Lettuce	top	1.1	51.4	2.6	54.2	0.031	0.045

THE MARKET FOR CORN

DISTILLING

For our six plants in Canada where grain is used in the production of beverage alcohol, we purchase upwards of 5½ million bushels of corn per year. All corn used at two Ontario plants and four in Eastern Canada are supplied primarily from the Ontario corn market. Due to the location and freight rates, plants in Manitoba and British Columbia are supplied with U.S. grown corn.

For the past two years we have purchased a quantity of corn grown in Quebec for our Lasalle, Que., plant. We also purchased a quantity of Manitoba corn for our Gimli plant. **W. H. Timmis, House of Seagram.**

CEREAL PROCESSING

There are two plants in Canada where corn is processed into cereal products for human consumption or for industrial users. Cereal manufacturers have established rigid standards of quality (sizing, high test weight, low moisture, less than 1% cracked, or foreign material) and are paying premiums on this quality and selection. **S. Lockington, Quaker Oats Company.**

WET PROCESSING

Our plant at Cardinal, Ont. uses between 5½ and 6 million bushels of corn. In the last two years, 95 percent of it has come from southwestern Ontario. **D. A. Ross, Canada Starch Company.**

FEED MANUFACTURER'S POINT OF VIEW

Western Ontario has used corn extensively for many years. However, transportation costs made it uneconomical to use large quantities of corn in other parts of Ontario, and Western Canada grain was used instead. Up to 3 years ago some U.S. corn was brought into bay ports and St. Lawrence River ports for the feed manufacturing trade. This was generally in the summer months prior to harvest when shortage of Ontario corn became apparent, or U.S. corn could be distributed cheaper than Ontario corn. However in recent years little or no corn has come into Ontario for feed purposes. When we examine the scene today we find that about 100 million bushels is produced in Ontario, whereas 20 years ago only 11 million bushels was produced. We now have large quantities grown in central and Eastern Ontario and prices of corn are virtually the same in Eastern and Western Ontario.

If through supply or other factors the price of corn is not competitive, the feed manufacturer will switch to other sources, e.g. Western grain. **Alf Walberg, United Cooperatives of Ontario.**

LIVESTOCK FEED

With cow numbers remaining stable in Ontario, Ontario feeders will have to continue to go west for calves, and with population increases, will need an increasing number of calves from the West to meet the demand. In bidding for calves against the Western feeder, the Ontario feeder, in effect, is bidding his feed costs against the Western feeder's feed (barley and wheat). What the Western feeder's grain costs are is probably largely determined by international market demands for western grains.

There are two ways that the Ontario feeder can keep his feed costs down—(1) through high corn silage rations as compared to high grain rations; (2) by growing his corn, or by harvest time purchase from a neighbor, as opposed to purchase through commercial channels. A look at corn silage acreage points out the increasing use of silage, the feed that puts on the cheapest gains. The greatest increase in silage acreage is where you would expect it, in Western Ontario—but perhaps of more significance is the increase in Southern Ontario in spite of declining dairy and beef cattle numbers. **H. Wright, Ontario Department of Agriculture and Food.**

PRODUCTION POTENTIAL

BASIC RESOURCES

Production of grain corn in Canada reached 100 million bushels in 1970. Ontario's 1971 production is expected to be 90 million bushels. Corn is the main grain crop in Ontario, equal to production of all other grains combined. Better hybrids have contributed about 1 bu/acre/year increase and improved cultural practices ½ bu/acre/year. In light of these facts, we could have an Ontario corn crop of 180-200 million bushels by 1980.

Corn acreage in Alberta in 1971 amounted to about 8,000 acres of which 2,000 is for grain. Land suitable for corn in irrigated areas is estimated at 3-400,000 acres. Yields of 70 bu/acre are attainable and the crop has a ready market for poultry feeds and distilling. Cost of production in Alberta is currently higher than in most areas of Ontario because of lower yields, irrigation costs, and effect of early frosts.

In Manitoba, there are about 8,000 acres of grain corn in the Red River Valley and 3,000 acres near Brandon, as well as 30,000 acres of corn silage. Corn south of Winnipeg is largely destined for distilleries. It is possible that up to 60,000 acres of grain corn could be grown south of Winnipeg for the distillery market.

In B.C., 20,000 acres of corn was grown for silage in 1971. **R. B. Hunter, University of Guelph.**

LEADERS IN THE GRAIN CORN INDUSTRY OUTLINED THEIR ROLE AT AN ONTARIO CONFERENCE AT RIDGETOWN, SEPTEMBER 1971

BUILDING AN INDUSTRY

MARKET EXPANSION

EXPORT POSSIBILITIES

With production so far not being sufficient for local consumption, Canadian producers have had better prices than their southern neighbours, particularly as they have the protection of 8 cents a bushel duty and, for many years, an advantage in the exchange rate. If production continues to increase, however, and a surplus exists, farmers and merchandizers will have to live up to the quality and condition standards for industrial and feed corn of important countries. Economical handling and transportation to terminal elevators at seaboard is imperative.

Basically, Europe is self-supporting in barley, soft wheat and feed wheat. Productivity is increasing at 5 to 7 per cent per annum and it is probable that corn production will at least double. Fortunately for us, the quality of corn grown in northern Europe is very much lower than corn grown in North America because of relative lack of sunshine, and adequate rain. Northern European corn is not liked by the distilling, starch and glucose factories. It is reasonable to suppose that for at least 10 to 15 years, imports of corn for these purposes as opposed to animal feed are likely to increase in Europe, provided the industries continue to progress as they have in the past. The market for these industrial uses in northern Europe, including the United Kingdom, is estimated at 350,000 tons per month. Provided the South Africans do not continue to have bumper crops, the majority of this market is likely to be supplied by North America.

Except in years of drought and relatively low crops, prospects for feed corn in Europe continue to deteriorate. There is a big corn import market in Japan, but it is not easily accessible from eastern Canada. United States, shipping from the Gulf of Mexico, Argentina and South Africa are better situated for shipments in that direction. **R. Strauss, Agro Co.**

CORN ACREAGE EXPANSION

	EASTERN ONTARIO		QUEBEC	
	Grain	Fodder	Grain	Fodder
1965	11,100	58,600	Not reported	65,600
1969	45,000	105,000	45,000	93,100
1970 (preliminary)	65,000	103,000	93,450	100,000

John Curtis, Kemptville College of Agricultural Technology.

ON CORN MOVING EAST

While elevator space is available on the Lower St. Lawrence, grain moving by rail is second to grain moving by water. For this reason, and because it is easier to buy a vessel load of corn than an equivalent quantity moved in hundreds of cars, buyers are understandably reluctant to take in Ontario corn unless the price discount allowed below American corn compensates or justifies the risks involved in moving a given quantity of corn by rail.

Ontario corn does move by water, but only in periods of surplus. Generally, Ontario port storage facilities are limited, making it difficult to accumulate sufficient corn to load a medium or large size vessel.

Transportation and storage problems will have to be overcome if Ontario corn is to be available, in competition with American corn and Western grains, on a year round basis in Eastern Canada. **M. Lavallée, Co-op Fédérée.**

FUTURES MARKET

The important thing to remember about hedging is that when anyone owns cash corn and is short futures against it, it is possible to make a profit on this ownership regardless of whether the price of corn is going up or down. On the other hand, owning cash corn without a a forward sale of the product into which the corn will be manufactured, or a hedge sale on the futures exchange, can only result in a profit if corn prices advance. The unpredictability of price movements gives considerable justification to a hedging position. **Robert Tebbutt, Merrill Lynch Pierce, Fenner & Smith Inc.**

TIES THAT BIND

ROLE OF RESEARCH

The formation of the Ontario Corn Committee in the late thirties was the result of the interest of various government workers in the 'Old Corn Belt' of Ontario in the promotion of hybrid corn in the province. The original committee can take most of the credit for the rapid changeover in Ontario from open pollinated varieties to hybrids. The testing program also served as the vehicle for licensing hybrids for sale in Canada.

Between 1940 and 1960, the functions of the Ontario Corn Committee did not change too drastically. In 1961, a new series of tests were undertaken by the committee which are now well known as the Performance Trials. These yield trials are made up of hybrids already on the Recommended List and the results are published each year.

In the mid sixties, the Ontario Corn Committee assumed another role, that of coordinating corn production research conducted at the various government institutions in Ontario, namely Harrow Research Station, Ridgetown College of Agricultural Technology, University of Guelph, Kemptville College of Agricultural Technology and Ot-

tawa Research Station. Today, this is probably one of the most important functions of the committee. If any facet of the corn industry feels that research is lacking in certain areas, then it should be brought to the attention of the Ontario Corn Committee for discussion. Often information is available on a subject that is not common knowledge.

Corn breeding programs are carried out at 3 locations in Ontario; Research Stations at Harrow and Ottawa, and University of Guelph. Each of the programs have different objectives. The Harrow program emphasizes the isolation of inbred lines with stalk rot resistance and European corn borer resistance in addition to the other desirable agronomic characteristics of a good inbred. These inbreds are made available to corn breeders of private companies as well as other institutions. A few hybrids are also released to private companies. Lines are also developed for use in research programs.

The Ottawa program emphasizes the development of very early inbred lines and hybrids for the northern areas of corn production. Many early hybrids have been released to seed corn companies by the Ottawa Station. The Ottawa program has probably done more to extend corn growing into eastern Ontario over the past 10-15 years than all other breeding programs together through the development of earlier inbreds and hence hybrids early enough for the area.

Numerous more sophisticated studies are conducted on corn at the various Research Stations and Agricultural Colleges which may or may not have an immediate impact on the corn industry. However, they are a very important part of research on any crop.

To give you some idea of the amount of effort put into corn research in Ontario, the following table gives the number of man years devoted to this crop. These figures include only plant breeders, agronomists, plant cytologists and plant physiologists and not pathologists, entomologists, soils and weed specialists.

Present membership of the Ontario Corn Committee consists of representatives from

1. Each of the 5 Research Stations and Agricultural Colleges engaged in corn research–
   - Harrow Research Station
   - Ottawa Research Station
   - Ridgetown College of Agricultural Technology
   - Kemptville College of Agricultural Technology
   - University of Guelph
2. Production and Rural Development Division of O.D.A.F.
3. Ontario Soils and Crop Association
4. Canadian Seed Growers' Association
5. Ontario Seed Corn Growers' Association
6. Plant Products Division, C.D.A.

The membership of the committee indicates the scope of representation from the corn industry. Farmer representation is through two groups: the Ontario Soils and Crop Association and Production and Rural Development group. **Dr. G. C. Russell, Director, C.D.A. Research Station, Harrow, Ont.**

MAN YEARS DEVOTED TO CORN RESEARCH

	Professional	Post Graduate & Research Associates	Technical	Labor
Harrow Research Station	1.55		1.70	3.30
R.C.A.T.	0.87		1.29	0.93
U. of Guelph	2.49	3.75	6.00	6.14
K.C.A.T.	0.28		0.50	0.33
Ottawa Research Station	3.40		2.30	5.50
	8.59	3.75	11.79	16.20

DISPOSITION OF CROP

Of 69.8 million bushels of corn produced in Ontario in 1969, 25.5 million bushels, or 37 percent, did not enter commercial channels but was consumed on the farm. A further 32 percent moved off farms into commercial channels returning to Ontario farms as livestock feed. A further 4 percent was shipped to Quebec and Maritime feed plants for processing into livestock feeds. Industrial users, including distilleries, starch and breakfast food manufacturers, consumed 26 percent of the crop.

Primary storage available for Ontario grains amounts to 76.3 million bushels, including 55.0 million on farms; 14.3 million in country elevators; 5.0 million in feed mills; and 2.0 million by industrial users. **G. McNern, Norfolk Co-op.**

ON GOVERNMENT POLICIES

There are two possible consequences of the drift toward provincial marketing quotas with some form of national coordination. (a) The retreat to provincial self-sufficiency, if it occurs, could well shrink Ontario output of poultry products relative to what it could be, and in the case of eggs, relative to what it has been. This has already occurred with respect to chicken broilers. (b) There isn't any doubt that administrative controls as to who can produce a product and how much they can produce takes the edge off the ability of an industry to adjust to competitive forces. It can be argued that this is no longer important–other provinces would all be in the same boat. But it is important with respect to international competition–particularly in the egg and turkey industries.

If the current planning in the poultry industry materializes as viewed by the interest groups involved, the next battle will be on an international front with respect to control of imports from south of the border. Policies here have a much broader notation than the proposal that imports can be simply licensed by the commodity groups concerned. Needless to say, the interests of the corn industry will not be well served should we find ourselves ill equipped to compete for our own markets for poultry products. **R. G. Marshall, University of Guelph.**

MARKET INFORMATION

One of the major elements in any marketing decision must be an appraisal of government commodity policy and an attempt to forecast any impending revisions to it. Unless the role of governement is fully taken into account, an otherwise astute evaluation is likely to be worse than meaningless. Analyzing a market requires critical study of the supply/demand situation but the answer generated from this basic appraisal must be recast in the light of public policy, government restrictions, both local and international, and the practicalities of the market in which you are dealing. **H. Heimbecker, Parrish & Heimbecker Ltd.**

A FARMER REACTION

There must be a producer controlled and operated Canadian feed grains commission, or exchange, with an Eastern section called the Canadian Commercial Corn Commission, with no connection to the Wheat Board. It would be responsible for grades and market regulations. Most important among these would be licensing of dealers, importers and exporters to see a market adequately supplied first with Canadian corn, then with import permits.

This commission would collect and distribute market information. **George Morris, Merlin, Ont.**

WHERE TO, FROM HERE?

CONFERENCE RECOMMENDATIONS

General targets of the Ontario Corn Industry Conference.

Creation of an Ontario corn council, advisory committee, or similarly designated body which represents all stakeholders in the Ontario corn industry.

Study of transport and storage facilities to ensure continuity of supply and competitive position in Eastern Canada and off shore markets.

Increased elevator space in production areas.

Freight rate assistance for corn marketed in Eastern Canada equivalent to that enjoyed by Western grains, or elimination of existing assistance on Western grains.

Improved information and education programs. **K. M. Pretty, chairman–recommendations committee.**

FARMING BIGGER BY FARMING BETTER

D. W. MacDONALD

Se basant sur des recherches effectuées par le ministère de l'Agriculture du Canada, un producteur de lait de l'Île-du-Prince-Édouard a choisi une production plus intensive de fourrages, afin d'accroître la productivité de son exploitation laitière.

Summer visitors to Prince Edward Island are invariably struck by the pleasing patchwork of green fields, blue-green spruce hedges, neat farmsteads, rolling topography—and, to top it off, a red soil. It's a classic rural setting for living and working close to nature.

What casual visitors don't see perhaps, or appreciate, is the struggle with the environment and variation in topography required to earn that living. The appearance and character of the landscape is largely determined by use of the land. Without agriculture, Prince Edward Island would be covered with trees. But enterprising farmers have managed to supplant trees with more profitable and variable crops, thus adding a pleasing effect to the landscape.

In general economic terms, P.E.I. has sometimes been cited as a depressed area. But anyone who takes a closer look at the natural resources of the province, and how farmers put them to use, would get a different impression. For instance, nearly 35 percent of the Island consists of Charlottetown sandy loam, one of the better classes of soil, and one that plays an important role in the economy of this agricultural community. Given adequate rainfall (and rainfall is usually adequate in P.E.I.), this deep red, easily-worked soil offers a wide range of opportunities for agricultural development.

CENTURY-OLD FAMILY FARM

The Wood family at Mt. Herbert has been making a living on Charlottetown sandy loam for over a hundred years. The present operator, Sterling Wood is the third generation. His son Robert, who assumes a

Mr. MacDonald is Head, Periodicals Unit, CDA Information Division, Ottawa.

large share of the workload because of his father's ill health, is the fourth. It is evident the 160 acre farm has stood the test of time, being in a better state of tilth, and a higher state of fertility, than ever before. But, today this farm is up against new standards of productivity that require adjustment, if it is to remain competitive.

General farming is out! One has to specialize. Like others, Wood has become a manager-operator. He organizes new technology, and executes a production program. But he turns to specialists for technical know-how. One time he heard Dr. L. B. MacLeod, forage and cereal nutrition specialist (now Director) of the CDA Research Station at Charlottetown discussing forage management. Wood decided he could apply that kind of knowledge. It eventually led to a change of program, and continuation of farming on a more viable basis.

The conversation invariably gets around to forage management when Dr. MacLeod and Sterling Wood get together.

ASTUTE CATTLEMAN

Selective breeding over the years established Sterling Wood as one of the top producers of Dual Purpose Shorthorns in the country. In three of the last four years, Wood has led the Record of Performance ratings for Shorthorns with a herd average of 10,000 pounds of milk. Winter and summer, the whole production goes on the higher priced fluid milk market. A timely influx of visitors to the Island in the summer consumes any sharp increase in milk production at that time.

So Wood is not too badly off for a market. With 160 acres of land and 55 head of cattle (25 milking), he has more resources than many Island farmers. However, even he has to expand. But how do you get bigger, without getting into bigger trouble. Dr. J. H. Lovering, production economist at the CDA Research Station warns that unless one can farm better, farming bigger can mean trouble.

Fortunately, P.E.I. farmers have a number of alternatives. Hogs or poultry are possible. But Wood's skill was with dairy cattle and for him, farming with hogs or poultry might not be farming better.

One can always grow potatoes in P.E.I. Conditions are ideal for production of disease-free stock. Soil pH is generally low, and potato growers like it that way as an aid to scab control on tubers. But a dairy farmer going in big for potatoes has to compromise somewhere on pH requirements, if potatoes and livestock feed crops are combined in one rotation. There's not much room for compromise in farming today.

GRAIN GROWERS

P.E.I. farmers are noted for cereal production, achieving some of the higher yields in the country for oats, mixed grain, barley and wheat. Grain is made to order for hay and pasture rotations supporting dairy production. But disease and harvesting conditions have been a problem at times with cereals and some Island farmers are opting for corn as a more reliable source of feed energy for livestock.

The lighter soils of Prince Edward Island have proved well adapted to tobacco in recent years and the crop is expanding at an unprecedented rate. As a cash crop, it is valued close to potatoes in farm income, but high capital and labor investment, and special management skills rule it out on many P.E.I. farms.

Sterling Wood considered the options. But when he learned of the potential, he decided on a forage program featuring alfalfa.

SCIENTIFIC INVESTIGATION

At the CDA Research Station, Charlottetown, the emphasis is on finding answers to local problems. New varieties of grain are introduced and tested for the Atlantic region. Forage species are compared, fertilizer requirements determined, cutting and grazing methods assessed. The nutrition of livestock, particularly in relation to sources of protein or feeds produced in the area, is carefully investigated. Specialists at Charlottetown analyse the relative performance of many components that determine the

Sterling Wood's Dual Purpose Shorthorn herd is meeting the challenge of more efficient production on better quality forage.

economic potential for a range of farming systems. Information is passed on to farmers through the extension and production services of the P.E.I. Department of Agriculture.

Dr. MacLeod had data on the relative performance of old, standby, shallow-rooted red clover-timothy forage mixtures compared with the more productive, deep-rooted alfalfa-brome mixtures. There was no question that alfalfa-brome had greater potential. The traditional rap against alfalfa was that it wouldn't survive Maritime winter conditions.

Dr. McLeod could also show that with greater effort and careful investment in fertilizer and recommended varieties, alfalfa could be made to survive and to continue to produce at a high level. Dr. MacLeod enumerated the requirements for successful alfalfa production:

- —a well drained soil.
- —add lime—soils with a pH of 5.0 have to be brought up to 6.2 or 6.5 for alfalfa.
- —apply fertilizer generously, based on soil test. Other things being equal, liberal applications of N, P, and K, in proper balance, largely determine yield and length of stand. Nitrogen and phosphorus are particularly important in the seedling year. Potash adds to length of stand. Soils low in fertility may need as much as 800 to 1,000 pounds of 5-22-20 per acre at seeding.
- —Narragansett and Vernal varieties have historically proved most winter hardy and reliable at Charlottetown, but the newer Flemish varieties such as Alfa or Saranac give higher yields, regrow more rapidly and with good management and fertility survive winters very well.
- —inoculate seed.
- —seed without a nurse crop.
- —use cultipacker seeder for firm uniform seeding.
- —use enough seed—at least 10 pounds of alfalfa and 12 pounds of Saratoga brome per acre in a mixture.
- —single species forage stands are the most easily managed and fertilized, but one grass seeded with alfalfa provides insurance in case the legume winterkills.
- —delay cutting new seeding till late bud stage to allow root establishment.
- —avoid cutting in fall between September 15th and mid-October to allow build-up of food reserves.
- —apply maintenance fertilizer regularly in spring or fall, or when vigor slows.

Research at Charlottetown confirmed these keys to alfalfa production under Maritime conditions. Wood put them to work on his farm. He proved that alfalfa yields more, and lives longer on Charlottetown sandy loam than other forage mixtures. He has doubled production, not only through increased yield, but also greatly improved quality of his forage. High energy, high protein alfalfa reduced the need for expensive supplements in the dairy ration. It is more profitable to buy fertilizer for forage than protein feed for cattle.

VOLLA BARLEY

An increase in alfalfa acreage has been at the expense of grain on the Wood's Limewood Farm. Grains acreage has been cut from 50 to 25 acres partly on the yield potential of Volla barley, and partly on the availability of western feed grains in Prince Edward Island.

Under Wood's management, alfalfa-brome mixtures are yielding five tons of hay, in two cuts. How long will the stand stay in? Wood isn't quite sure, but his are still in excellent shape after 4 to 5 years. There's always a chance of winterkill with alfalfa. But chances are reduced by good fertilization and management practices. And Wood doesn't intend to stop feeding his alfalfa. It keeps the milk flowing, and that's Wood's livelihood.

A forage program keeps capital costs down, also large investments in machinery. The work will continue to be steady on this dairy farm. Under the present program, Wood should manage to remain competitive for many more years to come, and contribute immeasurably to the P.E.I. landscape with luxuriant green hayfields and pasture. ■

PINK-EYE IN CATTLE

E. V. LANGFORD and W. J. DORWARD

L'ophtalmie périodique des bovins entraîne une diminution de l'absorption d'aliments et, partant, une baisse de productivité, à cause de l'irritation, de la douleur et de la cécité qu'elle provoque. Le traitement est difficile et le grand nombre d'agents infectieux, d'espèces animales prédisposées, de facteurs prédisposants, et la susceptibilité variable suivant la race et l'âge de l'animal contribuent tous à accroître la complexité du problème et, jusqu'à un certain point, expliquent partiellement le désaccord des chercheurs sur certains aspects de cette maladie. À l'Institut fédéral de recherches vétérinaires (section de l'Ouest), on poursuit les travaux dans les domaines de la bactériologie, de l'immunologie et de l'histopathologie.

Pink-eye or infectious bovine keratoconjunctivitis is an important infectious disease wherever cattle are raised. The losses incurred by farmers and ranchers due to these diseases are almost impossible to calculate but an outbreak of pink-eye results in lowered food intake and consequent lowered productivity due to irritation, pain and blindness. Also there is an increase in the cost of labor for repeated treatment and the cost of medication. The Committee on Infectious Disease of Cattle of the U.S. Animal Health Association in their 1969 report, placed "Pink Eye" ahead of "Causes of Abortion" and "Neonatal Disease" in a list of three diseases requiring immediate research efforts.

The term pink-eye or infectious bovine keratoconjunctivitis is given to an infectious condition which is caused by a living agent and affects a variable percentage, 5 to 50%, of the exposed herd. The initial symptoms are slightly excessive tears. At this time

Dr. Langford and Dr. Dorward are with the Animal Pathology Division, Health of Animals Branch, Canada Department of Agriculture, Animal Diseases Research Institute (Western), Lethbridge, Alberta.

the blood vessels of the inner eyelid (conjunctiva) and the eyeball become more prominent. As the infection becomes acute the secretions increase in amount and contain pus. The conjunctiva and white portion of the eyeball (sclera) become inflamed and the blood vessels are very prominent. Small ulcers develop on the anterior clear portion of the eyeball (cornea) and a milky opacity may develop. Chronic cases develop a complete opacity of the eye with or without ulceration which may penetrate the cornea.

All affected animals are in pain; they resent handling and try to keep the affected eyes closed. There is either partial or complete loss of vision in the more severely affected eyes.

MILD AND SEVERE CASES

The duration of the condition in an affected eye is determined by the severity of the lesions. It varies from 3-5 days in mild cases to 6 weeks in those severely affected. Vision is usually recovered in severly affected eyes after several weeks or possibly even months. In a small proportion of the cases where the ulceration is severe, permanent blindness may result and in young calves death may occur presumably due to a meningitis.

Treatment is very time consuming since it requires the repeated catching and restraint of each animal in order that the medication may be applied to the affected tissues on several successive days. As the disease spreads through the herd over a period of one to three weeks, much labor is required for adequate treatment. In stubborn cases the antibiotic sensitivity of the organisms involved in the outbreak should be determined in order that the most efficacious treatment is given.

The disease has been the subject of intermittent studies both superficial and intensive since 1889. There is, however, no general agreement at this time as to the causative agent or agents, prevention, treatment or control. Still less is known about the epidemiology of the disease or the immune response of affected animals and little has been reported of the tissue changes which occur in affected eyes. A similar complex condition has been reported in a variety of domestic animals including cat, dog, sheep, goat, and also in man.

In cattle many organisms have been associated with the disease and suspected of being the causative or etiological agent. Ten bacterial species have been cited as the etiological agent with *Moraxella bovis* being implicated most frequently. Other infective agents have included a fungus, rickettsia-like organisms, a psittacoid and a viral agent, the latter also causes "Red Nose" (infectious bovine rhinotracheitis). Non-infectious factors that have been considered to be predisposing factors to infection include sunlight (ultraviolet rays) as exemplified by snow blindness, heat, moisture, dust, flies, moths, and a

vitamin A or B deficiency. An apparent breed susceptibility has been observed and a possible susceptibility rating would be Hereford, Jersey, Holstein-Friesian, Aberdeen Angus, Brahman, and Zebu. Although the Aberdeen Angus is rarely affected the disease is severe when it occurs in this breed.

VARIABLE INCIDENCE

The incidence of pink-eye is very variable and subject to many influences. The condition has been considered to be seasonal by many workers, being most prevalent in spring and summer. Fall outbreaks do occur however. Winter outbreaks have been related to crowded conditions such as are observed in feedlots. There is a higher incidence of infection in young stock under a year old and occasionally it is confined to the calves. Unilateral infection is most common. In a bilateral infection the second eye becomes affected soon after the first. The wide range of infective agents, susceptible animal species, predisposing factors, breed and age susceptibility, all emphasize the complexity of the problem and, to some degree, explain some of the disagreement among research workers on some aspects of the disease.

At the Animal Diseases Research Institute (Western) a continuing project for the study of pink-eye has been active since 1968. A microorganism previously unreported as a cause of pink-eye has been recovered from eye swabs taken from affected eyes in six of 10 herds. The organism, which has morphological and cultural characteristics between bacteria and viruses is a *Mycoplasma spp.* It has been recovered most frequently from early, severe, acute, untreated cases, less frequently from severe chronic cases and rarely from normal or mildly affected eyes. English workers simultaneously reported the isolation of an unidentified Mycoplasma from pink-eye in England.

NEW SPECIES

Typing and characterization studies have been carried out in England by Dr. Langford of the A.D.R.I. (W) and by Dr. R. H. Leach of the Mycoplasma Reference Laboratory at London. It has been proven that the Canadian Mycoplasma is a new species and that it is serologically the same as the English isolates available to these workers.

Sequential mycoplasma and bacterial infection has been reported in chronic respiratory disease of poultry. A mixed Mycoplasma and bacterial infection has also been reported in pneumonia of cattle, sheep and man. In pink-eye of sheep a Mycoplasma has been isolated by Australian workers, and shown to cause the disease in the absence of bacteria normally associated with the condition. The Mycoplasma isolation was made from the eyes of a naturally affected flock and in association with a bacterium *Neisseria ovis.* A similar observation has been made by us from an outbreak of Pink-eye in sheep in Southern Alberta. No observations were mad by either the English or Australian workers on a possible relationship between sequential infection and the severity of the lesions.

INDUCED INFECTION

Limited attempts have been made to produce pink-eye in animals known to be free of both Mycoplasma and *M. bovis.* In the first a mixture of the organisms was instilled into the eyes of six animals; none of these showed clinical symptoms, however four in-contact animals developed pink-eye and both organisms were isolated. In the second attempt four animals were exposed to the Mycoplasma without mechanical injury and two animals were left as contacts. One eye developed a severe acute case of pink-eye, two eyes showed minor changes associated with early pink-eye for a period of 48 hours. The remainder of the contact and exposed eyes remained normal. Within nine days Mycoplasma had been recovered from every eye in the group and isolations were made up to 120 days post-exposure. *M. bovis* was not recovered from any of the eyes.

Although the discovery that a new species of Mycoplasma has a role in causing pink-eye seems to further complicate this hard-to-crack disease, it may indicate a possible multiple etiology. It would appear from the available information that the following conditions are necessary for an outbreak to occur in a herd: (1) a susceptible group of (a) young animals or (b) a previously unexposed group of older animals (2) the presence of a predisposing factor or factors as sunlight, dust or wind (3) exposure of the eye to one or more of the presumed agents such as *M. bovis*, a Mycoplasma or other infectious agent.

The severity of the condition in individual animals may be related to: (1) the severity of the predisposing trauma (2) the presence of more than one causative agent in the eye, thus a dual or possible even a triple infection might be involved (3) the lack of or a low level of immunity to infectious agents which may cause the condition.

Although the studies completed to date indicate that the previously unreported Mycoplasma is implicated in and moreover may have some effect on the severity of the condition, further studies are needed to define its role. At the A.D.R.I. (W) work is continuing in the disciplines of bacteriology, immunology and histopathology.

It is hoped that a study of this nature will yield helpful information which could clarify the immune response of the host, the maintenance and transmission of the infective agent or agents, and predisposing factors which lead to herd outbreak. Such information could be the basis for logical and effective preventive treatment and control measures for the bovine and other domestic animals. ■

ONCE-OVER HARVEST FOR BROCCOLI

J. A. CUTCLIFFE

On peut obtenir, en une seule récolte, des rendements commerciaux d'environ 3 tonnes de brocoli à l'acre avec les variétés dont on dispose actuellement, en portant la densité du peuplement à plus de 24,000 plants à l'acre et en augmentant de 100 à 125 livres à l'acre la dose d'engrais azoté.

The need for mechanizing vegetable production and particularly the harvesting operation has greatly increased during recent years. This has intensified the need for new information on cultural practices adapted to once-over harvest. Total and early yields are becoming obsolete terms for many vegetable crops. The primary objective that must be considered is when and how maximum yields of acceptable produce can be obtained in a single harvesting operation by a mechanized harvester.

Historically, broccoli has been harvested by hand. Uneven maturity necessitates six to nine cuttings resulting in high labor requirements and costs. Thus, machine-harvesting is a prime goal of the industry. Investigations at the Charlottetown Research Station have been directed at the effects of plant population and nitrogen fertilization on yield and maturity of broccoli subjected to a once-over harvest.

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PLANT POPULATIONS

Results, over a 3-year period, indicate that single-harvest marketable yields of broccoli of about 3 tons per acre can be expected with presently available varieties such as 'Gem Hybrid'. However, to achieve such a yield at a single harvest, it is necessary to increase plant population to considerably greater numbers than for conventional plantings. Our results indicate that the optimum plant population is about 24,000 plants per acre (16 x 16 inches) in equidistant planting patterns. These are based on the least number of spears to handle and ease of cultivation. Total marketable yields were affected very little by greater plant populations but individual spear weight decreased as the spacing between plants decreased (See table).

Our results also indicate that single-harvest yields can be increased by applying 100-125 pounds per acre more nitrogen than is required for conventional spacing and multiple-harvesting.

A single-harvested crop of broccoli must be cut at the proper stage of maturity. We found that single-harvest yields of usable spears increased from the day that the earliest of these showed open flowers (i.e. became over-mature) until the time when about 10% of the spears were over-mature. Yields of good spears remained relatively constant for the following 3 to 4-day period during which the over-mature spears increased to about 23%. Thus, the optimum harvest period extends over a 3 to 4-day period beginning and ending when about 11 and 23%, respectively, of the spears are over-mature.

While machines that will effectively and economically harvest broccoli have not yet been developed, our investigations indicate that broccoli is adaptable to a single-harvest and machine-harvesting. The prime goal of the industry, therefore is considered feasible.

In the meantime, broccoli growers can reduce harvesting costs by adopting some of these crop management practices and by harvesting, once-over, by hand. ■

EFFECT OF PLANT POPULATION ON YIELD AND SPEAR WEIGHT OF SINGLE-HARVESTED BROCCOLI.

Spacing (inches)	No. plants per acre	Marketable yield tons / acre	Mean spear weight (pounds)
8 x 8	98,030	2.92	0.10
8.9 x 8.9	79,970	2.56	0.11
9.8 x 9.8	65,230	2.74	0.12
10.9 x 10.9	53,210	3.03	0.16
12 x 12	43,410	2.97	0.19
13.3 x 13.3	35,420	3.00	0.23
14.7 x 14.7	28,890	2.88	0.27
16.3 x 16.3	23,560	3.08	0.36
18.1 x 18.1	19,230	2.83	0.38
20 x 20	15,680	2.80	0.48

CANADA AGRICULTURE